PUBLIC SERVICE COMMISSION OF WISCONSIN
Memorandum

January 10, 2012

TO: The Commission

FROM: Robert Norcross, Administrator
Jim Lepinski, Docket Coordinator
Michael John Jaeger, Environmental Analyst
Gas and Energy Division

RE: Application of Highland Wind Farm, LLC, for a Certificate of Public Convenience and Necessity to Construct a 102.5 Megawatt Wind Electric Generation Facility and Associated Electric Facilities, to be Located in the Towns of Forest and Cylon, St. Croix County, Wisconsin — 2535-CE-100

BRIEFING MEMORANDUM

Statement of the Proceeding

On December 19, 2011, pursuant to Wis. Stat. § 196.491 and Wis. Admin. Code chs. PSC 4 and 111, Highland Wind Farm, LLC (Highland) filed with the Commission an application for a Certificate of Public Convenience and Necessity (CPCN) to construct a new wind electric generation facility. The project includes construction of up to 44 wind electric generating turbines, depending on turbine model selected, and associated facilities to interconnect with the existing Northern States Power Company-Wisconsin (NSPW) electric transmission system in the area.

The Commission found the application to be complete on March 29, 2012. A Notice of Proceeding was issued on April 20, 2012. A Notice of Prehearing Conference was issued on May 24, 2012, and a prehearing subsequently held on May 30, 2012. Requests to intervene were granted to:

- Clean Wisconsin (Clean WI)
- Forest Voice, Inc. (Forest Voice)
- RENEW Wisconsin (RENEW)
- Town of Forest

Subsequently, requests for intervenor compensation (IC) were filed by Forest Voice and Clean WI. By Order dated July 20, 2012, the Commission modified and approved Forest Voice's application for IC in the amount of $20,000. By Order dated June 25, 2012, the Commission modified and approved an application for IC filed by Clean WI in the amount of $43,000. By Order dated December 3, 2012, the Commission modified and approved the supplemental IC application of Clean WI and Forest Voice in the amount of $21,929, for measurement of infrasound and low frequency noise (ILFN) at the Shirley Wind Farm (Shirley). (A supplement to this Briefing Memo addressing the ILFN measurements will be prepared by Commission staff.)

The Commission held technical hearings in Madison on October 9, 10, and December 3, 2012. An additional technical hearing session regarding ILFN measurements at Shirley is scheduled for January 17, 2013. Public hearings were held in the project area on October 11, 2012, in Forest, Wisconsin. The issue for hearing, as determined at the May 30, 2012, prehearing conference, was:

> Does the project comply with the applicable standards under Wis. Stat. §§ 1.11, 1.12, 196.025, 196.49, and 196.491, and Wis. Admin. Code chs. PSC 4 and 111?

Initial and reply briefs were filed on December 17, 2012, and January 3, 2013, respectively. Initial briefs opposing the project, or aspects of it, were filed by Forest Voice and the town of Forest. Clean WI and Highland filed initial briefs in support of the project. Reply briefs were filed by Clean WI, Forest Voice, the town of Forest, and Highland.

Comments on the proposed project were requested from members of the public in the Commission's August 31, 2012, Notice of Hearing. Delayed Ex.-PSC-Lepinski-3 includes all written public comments received in response to the Commission's Notice of Hearing, including those received through the Commission's web comment form, written comments submitted by

U.S. mail, and written comments submitted at the public hearings in the project area. Appearance slips for members of the public attending the public hearing are also included in the exhibit.

Project Description

Highland proposes to construct a new wind electric generation facility in the towns of Forest and Cylon, in northeast St. Croix County, Wisconsin. The project would include up to 44 wind turbines with an electric generating capacity of up to 102.5 megawatts (MW), depending on the turbine model selected. The facility would consist of the wind turbines, access roads to the turbines, an underground 34.5 kilovolt (kV) cable system to collect the power produced at each turbine, a new interconnection substation to connect the facility to the existing electric transmission system, an operations and maintenance (O&M) building, and associated facilities. All of the wind turbines would be located in the town of Forest. A portion of the electric collector circuits and the interconnection substation would be located in the town of Cylon.

The project area consists of about 26,500 acres of predominately agricultural land. Highland holds agreements with landowners for about 6,200 acres within the project area upon which project facilities could be located. The community of Forest lies in the southwestern corner of the project area.

Highland proposes to use one of three turbine models for the project. The overall height of the turbines would be between 491 and 497 feet, depending on the turbine selected. The turbine models, generating capacity, number required, and total facility generating capacity are included in Table 1.

Table 1 Wind turbine models under consideration

Turbine Model	Turbine Nameplate Capacity	Required Number of Turbines	Project Nameplate Capacity
Nordex N100	2.5 MW	41	102.5 MW
Nordex N117	2.4 MW	42	100.8 MW
Siemens SWT-2.3	2.3 MW	44	101.2 MW

Highland has identified 41 primary and 11 alternate sites in the project area capable of supporting wind turbine installations. Highland states that these sites have adequate wind resources and are acceptable considering environmental and other concerns.

In its CPCN application, Highland provided a proposed project layout consisting of the preferred 41 turbine sites for each of the wind turbine models under consideration. In response to specific concerns expressed by some residents of the project area at the public hearing, Highland provided revised project layouts which use alternate turbine sites rather than Highland's original preferred sites, to attempt to mitigate these concerns. These revised project layouts include 41, 42, and 44 turbines for the Nordex N100, Nordex N117, and Siemens SWT-2.3 turbines, respectively.

For the Commission to approve this application, Highland must demonstrate that the conditions in Wis. Stats. § 196,491(3)(d) are satisfied. However, because the proposed project would be a wholesale merchant plant, Highland does not need to show that the facility meets need requirement. Wis. Stats. § 196.491(3)(d)2.

Background Information on Issues Not Requiring Commission Decision

Stray Voltage

Wisconsin Admin. Code § PSC 128.17 states:

> **PSC 128.17 Stray voltage.** (1) TESTING REQUIRED. (a) An owner shall work with the local electric distribution company to test for stray voltage at all dairy and confined animal operations within 0.5 mile of a wind energy system facility pursuant to the stray voltage protocol established by the commission before any wind energy system construction activity that may interfere with testing commences and again after construction of the wind energy system is completed, except as otherwise specified by commission staff under par. (b).
> (b) Before any testing under par. (a) begins, an owner shall work with commission staff to determine the manner in which stray voltage testing will be conducted and on which properties. The electric distribution company serving a dairy or confined animal operation where testing is required under par. (a) shall conduct or arrange to conduct all required testing at the expense of the owner.

(2) RESULTS OF TESTING. An owner and the electric distribution company shall provide to commission staff the results of all stray voltage testing in writing.
(3) REQUIREMENT TO RECTIFY PROBLEMS. An owner shall work with the electric distribution company and farm owner to rectify any stray voltage problems attributable to the construction and operation of the wind energy system, in compliance with the commission's stray voltage protocol.

Some members of the public provided comments expressing concern that the proposed project could cause stray voltage problems. (Riba, Tr. at 969-71; Hoitomt, Tr. 827-34.) The Commission includes, as a standard order condition for any wind electric generation facility, a requirement that wind developers work with local electric distribution companies to test for stray voltage at all dairy operations within one-half mile of any project facility, prior to construction and again after the project is completed. This standard order condition is consistent with the requirements of Wis. Admin. Code § PSC 128.17.

Discussion of Docket Issues

1. Does the Highland project comply with the Energy Priorities Law, Wis. Stat. § 1.12(4)?

Uncontested Alternative: Yes.

2. Has Highland considered the use of brownfield sites to the extent practicable as required by Wis. Stat. § 196.491(3)(d)8.?

Uncontested Alternative: Yes.

3. Should a condition of any CPCN require that Highland and its contractors, successors, assigns, and corporate affiliates comply with all the commitments that Highland included in its application and subsequent filings, and the provisions of this Final Decision?

Uncontested Alternative: Yes.

4. Will the project avoid unreasonably interfering with orderly land use and development plans for the area involved?

Highland and the town of Forest disagreed regarding the intent of the town's planning document, titled "Town of Forest Comprehensive Plan 2009-2030" (Comprehensive Plan,

Ex.-HWF-Mundinger-3.) Highland stated that the proposed project would not interfere with orderly land use and development plans. Highland stated that its position is supported by several factors, including: the sparsely developed rural character of the project area (Sur-Surrebuttal-HWF-Hankard-4.); the Town's desire to maintain its rural, agricultural character (Rebuttal-HWF-Mundinger-3-4; Ex.-HWF-Mundinger-3 at 1.), and; the support for all types of renewable energy projects included in the town's Comprehensive Plan. (Direct-HWF-Mundinger-18; Ex.-HWF-Mundinger-3; Sur-Surrebuttal-HWF-Mundinger-3; Br. 26-8.)

Town of Forest witness Jaime Junker, the Town Chairman, testified that the Comprehensive Plan envisions: maintaining the rural character of the town; siting and designing large-scale businesses and developments to avoid conflicts with preserving the town's rural character; and limiting development such as the proposed project to only the hamlet of Forest and along State Highway 64. Chairman Junker also testified that although the Comprehensive Plan supports renewable energy development in the town, it should be read to mean small-scale renewable energy development, not development of the size and scope of the proposed project. (Direct-Forest-Junker-6-8; Br. 21-4.)

Additional testimony was received from Jay Mundinger supporting Highland's position that the proposed project is consistent with the town's Comprehensive Plan. (Rebuttal-HWF-Mundinger-1-5; Sur-Surrebuttal-HWF-Mundinger-1-4; Mundinger Tr. at 67-89, at 93-100, at 127-32, at 141-4, at 145; Ex.-HWF-Mundinger-3; Ex.-HWF-Mundinger-5; Ex.-HWF-Mundinger-6; Ex.-HWF-Mundinger-7; Ex.-HWF-Mundinger-8.) Mr. Junker also provided additional testimony that the proposed project is not consistent with the Comprehensive Plan. (Direct-Forest-Junker-2-36; Surrebuttal-Forest-Junker-2-7; Junker, Tr. 664-97; Ex.-Forest-Junker-1 through 17.) Many members of the public provided comments regarding whether the

proposed project is compatible with the Comprehensive Plan. (Matthew Radintz, Tr. at 745-52; Janet Monson, Tr. at 853-5; Pat Scepurek, Tr.at 941-48; Douglas Karau, Tr. at 799-808; *et. al.*)

Alternative One: Yes, the proposed project avoids unreasonably interfering with orderly land use and development plans for the area involved.

Alternative Two: No, the proposed project would unreasonably interfere with orderly land use and development plans for the area involved.

5. Are Highland's noise modeling assumptions reasonable?

Sound level weighting curves are described in Section 5.8.1.2 of the Commission's Environmental Impact Statement (EIS) for the Glacier Hills Wind Project, docket 6630-CE-302:

> Everyday sounds are comprised of sound waves of many different frequencies. The frequency of a sound wave is measured in Hz, with one Hz equal to one sound wave cycle per second. Sound levels are measured with a device called a sound level meter in units known as decibels (dB).
>
> While the frequency range of human hearing is generally accepted to be between 20 to 20,000 Hz, the human ear is not equally sensitive to sounds through that entire range. Accordingly, when sound level measurements are taken, it is customary to use weighting curves in conjunction with the sound level meter to approximate the frequency sensitivity of human hearing. Three internationally standardized weighting characteristic curves exist for sound measurements: characteristic A for sound levels below about 55 dB, characteristic B for sound levels between about 55 and 85 dB, and characteristic C for sound levels above about 85 dB.[1] In practice, the B weighting characteristic curve is rarely used. A graphical representation of these weighting curves is included in Figure 5.8-1. When sound levels are measured using a weighting characteristic, the measurements are designated by adding the characteristic curve letter after the abbreviation for decibels, such as 58 dBA.
>
> In some instances, sound level measurements are taken without weighting. Those sound levels are typically expressed in dB, and are referred to as unweighted sound levels.
>
> (Ex.-PSC-Jaeger-4 at 70.)

Sound level reporting is addressed in 5.8.1.5 of the Glacier Hills EIS:

> When sound level measurements are taken over a period of time, the overall sound level is expressed as L_{eq}. This quantity can be thought of as the equivalent or average sound

[1] Beckwith and Buck, Mechanical Measurements, Second Edition, 1969.

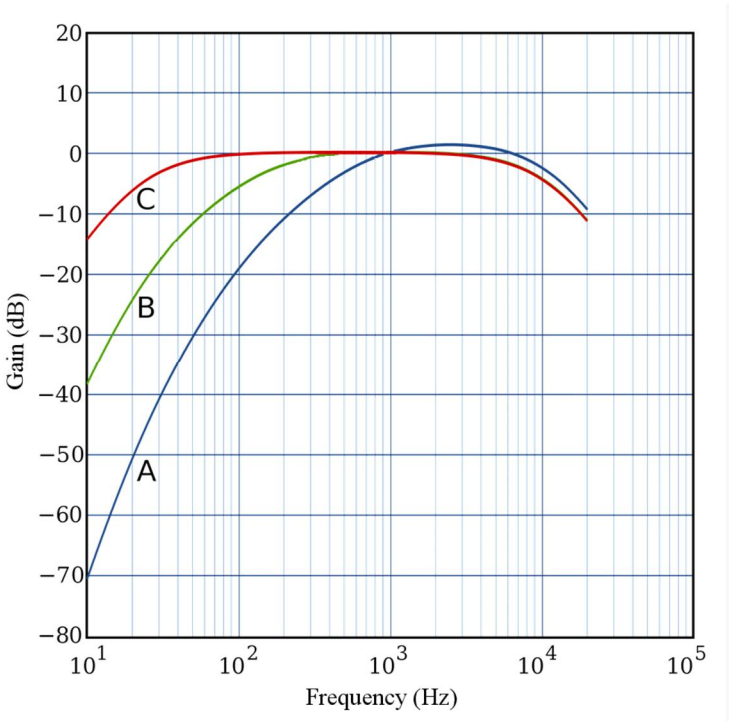
level over the period of the measurement, and may be expressed in dBA, dBC, or unweighted dB.

In addition to L_{eq}, a number of statistical sound level measures are commonly used to characterize noise environments. One of the more important of these statistical measures is L_{90} noise levels in both dBA and dBC. The L_{90} is the sound level that is exceeded 90 percent of the time, and is generally accepted to represent the sound that is nearly always present in a given noise environment, as it reduces the influence on the measurements of short-duration, transient noises such as automobile drive-bys and aircraft fly-overs. Some other statistical measures commonly used include L_{10} and L_{50}, which represent the sound levels exceeded 10 and 50 percent of the time, respectively.

Octave band measurements are often used to characterize sounds over the frequency range. These measurements quantify the sound level in specific frequency ranges, which are typically centered at 16, 32, 63, 125, 250, 500, 1000, 2000, 4000, and 8000 Hz. One-third octave band measurements are sometimes used, where there would be three measurements in each octave at various center frequencies. Octave band measurements can be reported in dBA, dBC, or dB, and in any of the statistical measures.

Because of the differences in the A-weighted and C-weighted characteristic curves, subtracting the dBA measurement from the dBC measurement yields a rough estimate of the low-frequency component of the sound. Referring to Figure 5.8-1, the difference between the L_{eq} in dBA and the L_{eq} in dBC would result in a numerical representation of the area under the C-weighting curve that does not also lie under the A-weighting curve.

Figure 5.8 1 Sound level frequency weighting curves



(Ex.-PSC-Jaeger-4 at 71-2.)

Wisconsin Admin. Code § PSC 128.14(3) states:

> **PSC § 128.14** (3) NOISE LIMITS. (a) Except as provided in par. (b), subs. (4)(c) and (5), an owner shall operate the wind energy system so that the noise attributable to the wind energy system does not exceed 50 dBA during daytime hours and 45 dBA during nighttime hours.

Of the two common types of wind noise limits, absolute and ambient-based, the Wis. Admin. Code § PSC 128.14 noise limits are considered to be absolute. Absolute limits are maximum sound levels from wind facilities at sensitive receptors, regardless of the ambient sound level. Ambient-based noise limits specify some increment above the ambient sound level that may not be exceeded. (Ex.-CW-Hessler-6 at 98-9; Hankard, Tr. at 199-206; Hessler, Tr. at 477-9; Surrebuttal-Forest Voice-Horonjeff-6-9.)

The intent of the Wind Siting Council when drafting the Wis. Admin. Code § PSC 128 noise limits is documented in the *Wind Siting Council Final Recommendations to the Public Service Commission*, which states:

> For all system size categories, the noise attributable to the system should never be allowed to exceed 45 dBA at night or 50 dBA during the day, as measured at the outside wall of any nonparticipating residence or occupied community building.

(Ex.-HWF-Hankard-2 at 5, 19-22; Surrebuttal-Forest-Schomer-7.)

Clean WI witness David Hessler testified that, in order to meet an absolute limit 100 percent of the time, the design goal of the project would need to be up to 10 dBA below the noise limit. This would be necessary to avoid temporary excursions above of the noise limit, which Mr. Hessler states are unavoidable. Mr. Hessler also states that, if the measured sound level is in compliance 95 percent of the time or more, he would consider the development in compliance with an absolute limit. (Hessler, Tr. 524-5.)

In addition to pre-construction sound level measurements, the Commission's *Measurement Protocol for Sound and Vibration Assessment of Proposed and Existing Wind*

Electric Generation Plants (Noise Protocol) requires applicants to take post-construction measurements. (Ex.-HWF-Hankard-1.) The Noise Protocol requires that the post-construction noise study demonstrate compliance with applicable noise limits. (Ex.-HWF-Hankard-1 at 5.) This demonstration of compliance is included in the post-construction noise studies for the Glacier Hills Wind Project (docket 6630-CE-302, PSC REF#: 169890) and all other wind projects previously authorized by the Commission.

At typical setback distances, project-only and ambient sound levels are often of similar magnitudes, meaning that any total measured sound level is influenced by both sources. As such, it is not appropriate to assume that any measured sound level is entirely from the project or the ambient. Since Wis. Admin. Code § PSC 128.14 includes an absolute noise limit, the project-only sound level must be calculated by measuring the total sound level with the wind turbines operating, then subtracting the ambient sound level occurring under similar wind and atmospheric conditions. While there are difficulties involved in making these calculations, two methods have been used for previous post-construction noise studies filed with the Commission:

- Place continuously recording sound level monitors at points of interest within the project area to record the combined ambient and project sound levels. Place additional sound level monitors well away from the project but in areas with similar ambient sound levels and use those measurements to estimate the likely ambient sound level within the project area. Measure the sound levels both in the project area and away from the area over several days, correlate the measurements, and estimate the project-only sound level.
- Take ten-minute sound level measurements on a moderately windy day with all wind turbines within several miles of the measurement points operating, then take additional measurements immediately afterward with the turbines shutdown and the blades parked.

Under the second method, the wind speed must be within a narrow range such that the turbines are operating, yet the wind speed at the measurement point is not so high that the measurements

are highly influenced by "pseudo-noise" associated with air passing over the sound level meter microphone. (Ex.-HWF-Hankard-1.)

Mr. Hessler testified that mitigation options to achieve compliance after construction is complete are limited, should an exceedance of the applicable noise limit be identified during the post-construction noise study. As such, it is prudent to ensure compliance with applicable noise limits using accurate computer modeling prior to construction. (Rebuttal-CW-Hessler-8-9.)

As required by the Commission's Noise Protocol, Highland provided noise contour maps for the project as initially proposed. (Ex.-HWF-Hankard-1.) The sound contours were generated using the WindPRO computer modeling software, which implements ISO Standard 9613-2. (Ex.-HWF-Mundinger-1, Appendix V; Ex.-Forest-Schomer-9.) The sound contours provided in Highland's CPCN application use a ground absorption coefficient setting of 0.0 in the WindPRO software. (Ex.-HWF-Mundinger-1, Appendix V.) Commission staff's noise analysis of the project as initially proposed was completed solely on the modeling included in Highland's CPCN application. (Ex.-PSC-Jaeger-2 and 3.) In rebuttal testimony, Highland witness Joanne Blank provided WindPRO modeling using a ground absorption coefficient of 0.5. (Rebuttal-HWF-Blank-1-3; Ex.-HWF-Blank-1; Ex.-HWF-Blank-2.) As discussed previously, Highland provided revised project layouts to address concerns expressed by residents of the project area at the public hearing. These revised project layouts were developed using a ground absorption coefficient of 0.5. (Supplemental Direct-HWF-Mundinger-1-2; Ex.-HWF-Mundinger-9; Ex.-HWF-Mundinger-10, Schedule 1.)

In sound modeling, ground absorption coefficient is used to characterize the ability of the ground to attenuate sounds. A ground absorption coefficient of 0.0 represents hard, acoustically reflective ground, while a value of 1.0 represents highly-absorptive conditions. A ground

absorption coefficient of 0.5 represents semi-absorptive conditions. The lower the ground absorptivity value used, the higher the predicted sound level will be at residences represented in the model. Section 7.3 of ISO Standard 9613-2 specifies criteria for use of ground absorption coefficient values for various ground conditions. (Ex.-Forest-Schomer-9.) Wisconsin Admin. Code § PSC 128.14 does not address ground absorption.

Mr. Hessler testified that Highland's use of a 0.0 ground absorption coefficient would result in the highest predicted sound levels from the proposed project. (Direct-CW-Hessler-7-8.) As part of Mr. Hessler's analysis, he replicated Highland's sound modeling holding all other factors equal except for the ground absorption coefficient. (Ex.-CW-Hessler-2.) Mr. Hessler states that the results of his analysis show that the area of the 40 dBA contour using a ground absorption coefficient of 0.5 roughly resembles the area of the 45 dBA contour from Highland's modeling using a ground absorption coefficient of 0.0. Mr. Hessler further states that Highland's approach in its CPCN application suggests more negative noise impact on the community than will actually be the case. (Direct-CW-Hessler-8.) Mr. Hessler testified that field surveys of five recently completed projects similar to Highland found almost no noise complaints when the mean, long-term project sound level was about 40 dBA or less. (Direct-CW-Hessler-11.)

Additional testimony was presented by Mr. Hessler and Ms. Blank supporting use of the 0.5 ground absorption coefficient. (Hessler, Tr. at 498-500, 509-11, 519-20, 529-30; Blank, Tr. at 156-8, 162-71, 172-4.) Town of Forest witness Dr. Paul Schomer and Forest Voice witness Richard Horonjeff testified supporting use of the 0.0 ground absorption coefficient. (Schomer, Tr. 547-9, 553-8, 558-64, 570-2, 572-6, 576-9; Town of Forest Init. Br. at 11-3; Rebuttal-Forest Voice-Horonjeff-11-2; Forest Voice Init. Br. at 4-10.) In addition, Dr. Schomer testified

regarding the development and implementation of the ground absorption coefficient in ISO Standard 9613-2. (Schomer, Tr. 565-82.)

The Commission could determine that either the 0.0 or the 0.5 ground absorption coefficient is appropriate for use in modeling intended to comply with ISO Standard 9613-2. Use of the 0.0 ground absorption coefficient would, at least to some extent, minimize any temporary excursions above the Wis. Admin. Code § PSC 128.14(3) absolute noise limit. Additionally, the Commission could determine that the 0.0 ground absorption coefficient is appropriate considering the difficulties in establishing compliance with any absolute limit through field sound level measurements and the limited options for mitigation once the wind turbines are installed. Use of the 0.5 ground absorption coefficient would effectively reduce any safety factor in the modeling, but increase the amount of land available for development for wind energy purposes.

Alternatively, the Commission could defer a decision at this time and instead direct Highland, as part of any post-construction noise study for the proposed project, to estimate the actual ground absorption coefficient based on sound level measurements taken as part of the study and include those estimates in any post-construction noise study report.

Alternative One: A ground absorption coefficient of 0.0 is appropriate.

Alternative Two: A ground absorption coefficient of 0.5 is appropriate.

Alternative Three: Defer a decision at this time and instead direct Highland, as part of its post-construction noise study for the proposed project, to estimate the actual ground absorption coefficient based on sound level measurements taken as part of the study and include those estimates in the post-construction noise study report.

6. Based on the answer to the previous question, should the Commission direct staff to modify the Commission's Noise Protocol?

Wisconsin Admin. Code § PSC 128.50(2) states:

> **PSC 128.50** (2) COMMISSION PROTOCOLS. (a) The commission may periodically create and revise measurement, compliance, and testing protocols as needed to provide standards for evaluating compliance with this chapter. These protocols may be created and revised to reflect current industry practice, changes in the state of the art, and implementation of new technologies. The commission may make protocols under this subsection available to the public on the commission's website.

The Commission's Noise Protocol is currently the only such protocol existing under Wis. Admin. Code § PSC 128.50(2). The Noise Protocol does not currently specify a ground absorptivity coefficient to be used in sound level modeling. As such, the Commission could direct staff to update the Noise Protocol to reflect its decision in the previous question.

Alternative One: Yes, update the Commission's Noise Protocol to specify an appropriate ground absorption coefficient for pre-construction noise modeling in future wind project applications.

Alternative Two: Yes, update the Commission's Noise Protocol to specify that modeling be provided using ground absorption coefficients of both 0.0 and 0.5 for pre-construction noise modeling in future wind project applications.

Alternative Three: No, at this time, there is not an adequate basis to update the Commission's Noise Protocol regarding the appropriate ground absorption coefficient.

7. Should the Commission eliminate from use for the proposed project any or all of the three turbine model alternatives presented in the application?

The Commission's noise protocol requires that applicants provide sound level contours for the turbine models under consideration. (Ex.-HWF-Hankard-1 at 4.) This information was provided by Highland, and is shown in the series of maps included in Ex.-PSC-Jaeger-2,

Schedules 1 through 3, for the original layout for the Nordex N100, Nordex N117, and Siemens SWT-2.3 turbines, respectively.

The Commission's noise protocol also requires that applicants provide turbine manufacturers' unweighted octave band data for the wind turbine models under consideration for a proposed project. (Ex.-HWF-Hankard-1 at 4.) While that information was not included in Highland's application, octave band information in dBA was provided in Highland's response to the town of Forest's first set of interrogatories. (Ex.-HWF-Mundinger-1, Appendix V; Ex.-HWF-Hankard-3 at 1.) For the turbine models under consideration for this project, octave band information is included in the following table:

Table 2 Octave Band Center Frequency (Hertz, Hz)

Turbine Model	63	125	250	500	1000	2000	4000	8000
Nordex N100	87 dBA	93 dBA	100 dBA	101 dBA	100 dBA	95 dBA	93 dBA	85 dBA
Nordex N117	85 dBA	91 dBA	98 dBA	101 dBA	99 dBA	94 dBA	87 dBA	75 dBA
Siemens SWT-2.3	79 dBA	92 dBA	98 dBA	99 dBA	99 dBA	98 dBA	91 dBA	74 dBA

(Ex.-HWF-Hankard-3 at 1.)

In addition, town of Forest witness Dr. Schomer stated that the octave band spectra of the Nordex N100 2.5 MW turbine peaks in the 63 Hz octave band. (Surrebuttal-Forest-Schomer-14.)

Forest Voice witnesses Darren Ashley, Sarah Cappelle, and David Enz testified regarding their experiences as residents of the Shirley project area. (Direct-Forest Voice-D. Ashley-1-3; Direct-Forest Voice-Cappelle-1-3; Direct-Forest Voice-Enz-1-4.) These witnesses stated that it was necessary for them to abandon their residences after Shirley became operational. (Direct-Forest Voice-D. Ashley-1-3; Direct-Forest Voice-Cappelle-1-3; Direct-Forest Voice-Enz-1-4.) Commission staff understands that Nordex N100 2.5 MW turbines are installed at Shirley. As mentioned previously, a supplement to this Briefing Memorandum will address the ILFN measurements at Shirley.

Mr. Hessler testified that he was present when Mr. Ashley, Ms. Cappelle, and Mr. Enz testified, and does not doubt the Forest Voice witnesses. (Hessler, Tr. 462-3; 500-5.) Mr. Hessler also offered his thoughts that the turbine model used at Shirley may be contributing to the experiences of the Forest Voice witnesses. (Hessler, Tr. 515-7; 520-1; 523-34.)

As discussed previously, for the proposed project to have a generating capacity of 100 MW or greater, use of the Nordex N100 2.5 MW turbine would require Highland to construct turbines at 41 sites, use of the Nordex N117 2.4 MW turbine would require Highland to construct turbines at 42 sites, and use of the Siemens SWT-2.3 2.3 MW turbine would require Highland to construct turbines at 44 sites. (Ex.-HWF-Mundinger-1 at 14.)

Based on the noise performance of the turbine models proposed by Highland for the project, the testimony of the Forest Voice witnesses from the Shirley project area, and the testimony of Mr. Hessler, the Commission could eliminate from use for the proposed project any or all of the three turbine model alternatives presented in the application.

Alternative One: No, there is not an adequate basis to eliminate from use for the proposed project any or all of the three turbine model alternatives presented in the application.

Alternative Two: Yes, there is an adequate basis to eliminate from use for the proposed project any or all of the three turbine model alternatives presented in the application, as the Commission deems appropriate.

8. Should the Commission require Highland to design and operate the project consistent with the requirements of Wis. Admin. Code ch. PSC 128?

Wisconsin Admin. Code §§ PSC 128.02(3) and (4) state:

> **PSC 128.02** (3) COMMISSION APPLICATIONS. The commission shall consider whether the installation or use of a wind energy system is consistent with the standards specified in this chapter when reviewing an application under s. 196.491 (3) (d), Stats., filed on or after March 1, 2011.

> (4) INDIVIDUAL CONSIDERATION. Nothing in this chapter shall preclude the commission from giving individual consideration to exceptional or unusual situations and applying requirements to an individual wind energy system that may be lesser, greater, or different from those provided in this chapter.

Highland witness Mr. Mundinger states that Highland has designed the proposed project such that all 52 turbine sites meet the requirements of Wis. Admin. Code ch. PSC 128. (Direct-HWF-Mundinger-7.) In addition, Mr. Mundinger states that Highland has prepared computer modeling for both Wis. Admin. Code ch. PSC 128 sound level and shadow flicker requirements. (Direct-HWF-Mundinger-8.) Highland states that it believes the proposed project will comply with Wis. Admin. Code ch. PSC 128 in all respects. (Direct-HWF-Mundinger-8.)

8a. Alternative noise limit

As discussed previously, Wis. Admin, Code § PSC 128.14(3) provides for an absolute noise limit:

> **PSC 128.14** (3) NOISE LIMITS. (a) Except as provided in par. (b), subs. (4)(c) and (5), an owner shall operate the wind energy system so that the noise attributable to the wind energy system does not exceed 50 dBA during daytime hours and 45 dBA during nighttime hours.

The record in this docket includes considerable testimony regarding the appropriate noise limit for the proposed project. While Clean WI witness Mr. Hessler and Highland witness Michael Hankard testified that ambient sound levels in the Highland project area are similar to other wind energy development sites, town of Forest witnesses Dr. Schomer and Wesley Slaymaker testified that the Highland project area is uniquely quiet. (Hessler, Tr. 514-5; Rebuttal-HWF-Hankard-2-4; Surrebuttal-Forest-Schomer-5-6; Direct-Forest-Slaymaker-3.)

In their initial briefs, both Forest Voice and the town of Forest support an alternative nighttime noise limit of 40 dBA, rather than the 45 dBA limit currently included in Wis. Admin, Code § PSC 128.14(3). (Forest Voice Init. Br. at 10-9; Town of Forest Init. Br. at 7-13.) In its

initial brief, Clean WI supports use of the existing Wis. Admin. Code § PSC 128.14(3) noise standard. (Clean WI Init. Br. at 6-10.)

Forest Voice witness Mr. Horonjeff and town of Forest witnesses Dr. Jerry Punch and Dr. Schomer testified favoring lower design goals than those currently included in Wis. Admin. Code § PSC 128.14(3). (Rebuttal-Forest Voice-Horonjeff-12; Surrebuttal-Forest-Punch-17; Surrebuttal-Forest-Schomer-15; Forest Voice Init. Br. at 11-1, 18-9; Town of Forest Init. Br. at 7-11.)

Clean WI witness Mr. Hessler testified that, if possible, wind projects should use 40 dBA as an ideal design goal because there are few, if any, complaints below that level. Mr. Hessler continued that a regulatory limit of 45 dBA, such as that currently included in Wis. Admin, Code § PSC 128.14(3), balances the interests of the project developer and residents of the project area. (Hessler, Tr. at 467-8.) Mr. Hessler also stated that to achieve an actual sound level of 40 dBA at a given site, so many turbines may have to be removed that the project becomes unviable. (Hessler, Tr. 511-5; Clean WI Init. Br. at 8-10.)

In response to testimony regarding the use of a 40 dBA limit for the proposed project, Highland witness Mr. Hankard prepared an analysis regarding how the suggested design goal of 40 dBA would affect the original layout of the proposed project. Mr. Hankard used WindPro software to estimate the required setback distance from a single turbine to limit the sound level from the turbine to 40 dBA or less, using ground absorptivity coefficients of both 0.0 and 0.5. Mr. Hankard then applied these setback distances as buffers around existing non-participating residences, to determine which turbine locations would be eliminated and how much land would remain available for wind energy development. No adjustments to turbine locations, known as

micro-siting, were done as part of the analysis. The results of Mr. Hankard's analysis are summarized in Table 3.

Table 3

Ground Absorption Coefficient	Number of Sites in Original Layout	Number of Sites Remaining at 40 dBA Design Goal	Acres Available for Wind Energy Development at 45 dBA Design Goal	Acres Available for Wind Energy Development at 40 dBA Design Goal
0.0	52	3	450	54
0.5	52	18	450	310

(Supplemental-HWF-Hankard-1r-4r, Ex.-HWF-Hankard-4, Ex.-HWF-Hankard-5, Ex.-HWF-Hankard-6, Hankard, Tr. at 1074-9, at 1089-94, at 1097-8.)

Town of Forest witness Mr. Slaymaker provided testimony that he prepared computer modeling with Windfarmer software for the Nordex N100 turbine using a 40 dBA design limit and a ground absorptivity coefficient of 0.5. Mr. Slaymaker stated that the results of his modeling show that at least 22 Nordex N100 turbines totaling 55 MW could be constructed at the site. (Rebuttal-Forest-Slaymaker-1r-2r.)

The Commission could require that Highland redesign its proposed project using a 40 dBA design goal, and any ground absorption coefficient deemed appropriate by the Commission. The Commission could further require that Highland submit its redesigned project for Commission or Commission staff approval, as the Commission deems appropriate.

8b. Decommissioning requirements

In its CPCN application, Highland provided an estimate of decommissioning costs for the proposed project prepared by Michels Corporation (Michels). (Ex.HWF-Mundinger-1, Appendix F at 95-8 of 98.) This estimate was revised and expanded in response to Commission staff data requests. (Ex.-PSC-Lepinski-2, items 04.01, 05.01.) In summary, Michels estimates the cost of removal would average $133,700 per turbine. Michels further states that, depending

on the assumed salvage rate, the salvage value of the materials removed could completely offset cost of removal. (Ex.HWF-Mundinger-1, Appendix F at 95-8 of 98.)

Town of Forest witness John Stamberg prepared another estimate of decommissioning costs. Mr. Stamberg estimates the total decommissioning cost for the proposed project, net of any salvage value, to be $15,677,323. (Direct-Forest-Stamberg-3-18, Ex.-Forest-Stamberg-4-8, 8A, 9-15.)

In response to Mr. Stamberg's testimony, Highland witness Dan Pobloskie provided testimony supporting the Michels estimate as reasonable and critiquing Mr. Stamberg's estimate as being too high. (Rebuttal-HWF-Pobloskie-2-10.) Additional testimony was received by Messrs. Stamberg and Pobloskie regarding the decommissioning cost estimates. (Surrebuttal-Forest-Stamberg-1-8, Tr. at 615-56, (Supplemental) Rebuttal-Forest-Stamberg-1r-2r; Sur-surrebuttal-HWF-Pobloskie-1-8, Supplemental-HWF-Pobloskie-1-3, Tr. 332-58, Ex.-HWF-Pobloskie-2, Ex.-HWF-Pobloskie-3.)

Wisconsin Admin. Code PSC § 128.19(3) states:

> **PSC 128.19** (3) FINANCIAL RESPONSIBILITY. (a) The owner of a wind energy system with a nameplate capacity of one megawatt or larger shall maintain proof of the owner's ability to fund the actual and necessary cost to decommission the wind energy system and shall ensure the availability of funds necessary for decommissioning throughout the expected life of the wind energy system and through to completion of the decommissioning activities.
> (b) A political subdivision may require an owner of a wind energy system with a nameplate capacity of one megawatt or larger to provide financial assurance of the owner's ability to pay for the actual and necessary cost to decommission the wind energy system before commencing major civil construction activities such as blasting or foundation construction at the wind energy system site. An owner may comply with this paragraph by choosing to provide a bond, deposit, escrow account, irrevocable letter of credit, or some combination of these financial assurances, that will ensure the availability of funds necessary for decommissioning throughout the expected life of the wind energy system and through to completion of the decommissioning activities.
> (c) A political subdivision may require an owner to provide the financial assurance under par. (b) in an amount up to the estimated actual and necessary

cost to decommission the wind energy system. If a political subdivision requires an owner to provide financial assurance under par. (b), the political subdivision may do any of the following:

1. Require the owner to provide the political subdivision with up to 3 cost estimates of the actual and necessary cost to decommission the wind energy system that are prepared by third parties agreeable to the owner and the political subdivision.
3. Require an owner to establish financial assurance that places the political subdivision in a secured position, and that any secured funds may only be used for decommissioning the wind energy system until either the political subdivision determines that the wind energy system has been decommissioned under sub. (5) (b), or until the political subdivision has otherwise approved the release of the secured funds, whichever is earlier.
4. Require an owner to establish financial assurance that allows the political subdivision to access funds for the purpose of decommissioning the wind energy system if the owner does not decommission the wind energy system when decommissioning is required.

(d) If a political subdivision requires an owner to provide cost estimates under par. (c) 1., a political subdivision may not require the amount of the financial assurance to exceed the average of the cost estimates provided.

(e) A political subdivision may condition its approval of a wind energy system on the owner's compliance with pars. (b) and (c).

(f) During the useful life of a wind energy system, the political subdivision may periodically request information from the owner regarding the industry costs for decommissioning the wind energy system. If a political subdivision finds that the future anticipated cost to decommission the wind energy system is at least 10 percent more or less than the amount of financial assurance previously provided under par. (b), the political subdivision may correspondingly increase or decrease the amount of financial assurance required for the wind energy system. A political subdivision may not adjust the financial assurance under this paragraph more often than once in a 5−year period.

(g) A political subdivision may require an owner to submit to the political subdivision a substitute financial assurance of the owner's choosing under par. (b) if an event occurs that raises material concerns regarding the viability of the existing financial assurance.

The Commission could require Highland to follow the requirements of Wis. Admin. Code § PSC 128.19 regarding future decommissioning of the proposed project. The Commission could further require that Highland file with the Commission any decommissioning cost estimates required by the town of Forest under Wis. Admin. Code § PSC 128.19(3)(c)1. and reports of any periodic review and adjustment under Wis. Admin. Code § PSC 128.19(3)(f). In

its Reply Brief, Highland supports such a condition, but requests that Commission staff approve the three parties that would provide the decommissioning estimates.

8c. Underground collector circuits

Wisconsin Admin. Code § PSC 128.18(2) states:

> **PSC 128.18** (2) ELECTRICAL STANDARDS. (a) An owner shall construct, maintain, and operate collector circuit facilities in a manner that complies with the national electrical safety code and ch. PSC 114 and shall construct, maintain, and operate all wind energy system facilities in a manner that complies with the national electrical code.
> (b) An owner shall construct collector circuit facilities for a wind energy system underground to the extent practicable.
> (c) An owner shall establish an inspection schedule for all overhead collector circuits to ensure that third−party facilities, including cable television and telecommunications cables, are not attached or bonded to overhead collector circuit grounding. If third−party facilities are found attached to the overhead collector facilities, the owner shall ensure that the third−party facilities are promptly removed.

Highland states that it has wind energy lease and easement agreements that allow Highland to locate collector circuits on those properties. (Ex.-PSC-Lepinski-2, item 2.02.) In areas where Highland does not hold such agreements, it states that it would run "the collector circuits in the utility right-of-way (ROW) from the access road to the interconnection substation."[2] (Ex.-PSC-Lepinski-2, item 2.02; Ex.-HWF-Mundinger-1, Appendix B.) Highland states that it would need to obtain ROW permits for collector circuit and fiber optic control facilities from St. Croix County, the towns of Cylon and Forest, and Wisconsin Department of Transportation. (Direct-HWF-Mundinger-7-8.)

Highland may have to obtain additional property rights or local permits in order to locate collector circuits on properties for which it does not currently hold a wind energy lease and easement agreement. It is possible that the landowner or entity with control of the property could request that the facilities be constructed using an overhead configuration in these areas, or

[2] Commission staff expects that the word "road" should be substituted for the word "utility" in this quotation.

that other concerns make overhead construction an attractive option. As such, the Commission could require that all collector circuits for the proposed project be constructed using an underground configuration.

Alternative One: Yes, the provisions of Wis. Admin. Code ch. PSC 128 are adequate, and Highland should comply with all provisions of those rules.

Alternative Two: In addition to the provisions of Wis. Admin. Code ch. PSC 128, any or all of the following modifications to those requirements are appropriate:

8a. Reduce the nighttime noise limit from the proposed project to 40 dBA.

8b. Require Highland to follow the requirements of Wis. Admin. Code § PSC 128.19 regarding future decommissioning of the proposed project. In addition, require that Highland file with the Commission any decommissioning cost estimates required by the town of Forest under Wis. Admin. Code § PSC 128.19(3)(c)1. and reports of any periodic review and adjustment under Wis. Admin. Code § PSC 128.19(3)(f).

8c. Require Highland to construct all collector circuits for the proposed project using an underground configuration.

9. Are there any other conditions that should be applied to the proposed project?

9a. Post-construction noise study, including ILFN

As discussed previously, the Commission's Noise Protocol requires that the post-construction noise study demonstrate compliance with applicable noise limits. (Ex.-HWF-Hankard-1 at 5.) The Commission typically requires, as a condition of any authorization of a wind electric generation facility, that the applicant demonstrate compliance with applicable noise limits in a post-construction noise study to be filed with the Commission.

The generally accepted range of human hearing is between 20 and 20,000 Hz. (Ex.-PSC-Jaeger-2 at 70.) In testimony, Highland witness Mr. Hankard defined infrasound as sounds below 20 Hz, and low-frequency sounds as those between 20 and 200 Hz. (Hankard, Tr. at 211; Punch, Surrebuttal-Forest-Punch-5-6.) Mr. Hankard's definitions of these terms are consistent with Commissions staff's understanding of the correct use of the terms. Together, infrasound and low-frequency noise is often referred to as ILFN. Substantial testimony is included in the record regarding ILFN. (Direct-HWF-Hankard-9-10, Rebuttal-HWF-Hankard-4-5, Tr. 209-16; Rebuttal-HWF-Roberts-19-20, Sur-Surrebuttal-HWF-Roberts-10; Rebuttal-CW-Hessler-5-7, Tr. 453-65, 500-5, 505-9, 515-7, 521-9; Direct-Forest-Punch-5-14, Surrebuttal-Forest-Punch-4; Surrebuttal-Forest-Punch-16-7, Tr. 591-2, 593-602, 607-8, 611-3; Direct-Forest-Schomer-5-7, Surrebuttal-Forest-Schomer-1-5, Surrebuttal-Forest-Schomer-13-4, Tr. 542-6.)

Mr. Hankard also testified that he does not expect the Nordex turbines proposed for this project to be a significant source of low-frequency noise. (Direct-HWF-Hankard-9-10.)

While the Commission's Noise Protocol does require applicants to collect measurements in dBC and encourages applicants to take octave band measurements down to 16 Hz if possible, the Noise Protocol is not designed to collect infrasound measurements. (Hessler, Tr. at 521-2.)

The Commission could consider, as part of any order condition requiring a post-construction noise study, a requirement that Highland collect ILFN measurements. If the Commission includes such a requirement, it could also require Highland submit the design of the post-construction ILFN study for Commission or Commission staff approval prior to conducting any measurements.

9b. Property values

Highland witness Peter Poletti prepared and submitted a study of the property value impact for the proposed project. (Ex.-HWF-Poletti-3, Direct-HWF-Poletti-2-16.) Based on this study, Mr. Poletti concludes that construction and operation of the proposed project will not substantially injure or diminish the value of property surrounding or proximate to the proposed project. (Direct-HWF-Poletti-16.)

Forest Voice witness Kurt Kielisch provided testimony that the proposed project would have a negative impact on property value. (Rebuttal-Forest Voice-Kielisch-2-14.) Mr. Kielisch also suggests that the Commission, as a condition of any order it issues in this docket, require Highland to guarantee property values by providing a payment at the time of sale equal to the difference between the sales price and that of non-influenced comparable sales. (Rebuttal-Forest Voice-Kielisch-2-14; Forest Voice Init. Br. at 25-8.)

Additional testimony was received by Messrs. Poletti and Kielisch regarding property values. (Surrebuttal-HWF-Poletti-1-9, Sur-sur-surebuttal-HWF-Poletti-1-2, Tr. at 271-329; Sur-surrebuttal-Forest Voice-Kielisch-1-6, Tr. 24-51.) Several members of the public provided comments regarding the possible effects of the proposed project on property values. (Ex.-PSC-Lepinski-3 at 149, Miller; at 167, Goosens; at 399-400, Scott; Tr. at 903-9, Lombardo, *et. al*.)

The Commission could consider an order condition requiring Highland to guarantee property values by providing a payment at the time of sale equal to the difference between the sales price and that of non-influenced comparable sales. Because Highland committed to comply with Wis. Admin. Code ch. 128, the Commission may consider requiring compliance with the monetary compensation provisions in Wis. Admin. Code § PSC 128.33(3).

9c. Local roads

A member of the public, Ms. Ellen Ard submitted comments regarding financial responsibility for damage to local roads caused by heavy and oversized construction vehicles. (Tr. at 958-9.)

Highland states that, prior to commencement of construction, a survey of county and local road conditions within the project boundary will be performed. The roads will be videotaped before and after construction by an independent consultant acceptable to Highland, St. Croix County, and the towns of Cylon and Forest. Highland states that direct damage resulting from the proposed project will be repaired and returned to conditions mutually agreed upon by the affected jurisdictions, not to exceed pre-construction conditions as determined by the pre-construction survey. Alternatively, Highland and the affected jurisdictions may agree on a rate of compensation directly caused and related to traffic from the proposed project. (Ex.-HWF-Mundinger-1 at 22.)

The Commission could consider an order condition requiring Highland to work with affected jurisdictions regarding a plan to repair or compensate the jurisdictions for damage to county and local roads resulting from construction of the proposed project.

Alternative One: No other conditions should be applied to the proposed project.

Alternative Two: Any or all of the following conditions are appropriate:

9a. Require Highland, as part of any post-construction noise study, to collect infrasound and low-frequency sound measurements. The design of this study should be approved by either the Commission or Commission staff prior to conducting any measurements.

9b. 1. Require Highland to guarantee property values by providing a payment at the time of sale equal to the difference between the sales price and that of non-influenced comparable sales.

2. Require Highland to comply with the monetary compensation provisions in Wis. Admin. Code § 128.33(3).

9c. Require Highland to work with affected jurisdictions regarding a plan to repair or compensate the jurisdictions for damage to county and local roads resulting from construction of the proposed project.

10. If any of the preferred turbine sites do not meet the siting criteria of Wis. Stat. §§ 196.491(3)(d)3. or 4., should the Commission modify Highland's application to reduce potential individual hardships experienced by residents in close proximity to project facilities?

Commission staff's Environmental Assessment (EA) includes the following summaries of two major reviews by other states regarding potential health effects from wind turbine noise:

> The Minnesota Department of Health in 2009 reviewed the literature on wind turbine noise effects and concluded that:
>
> > "The most common complaint in various studies of wind turbine effects on people is annoyance or an impact on quality of life. Sleeplessness and headache are the most common health complaints and are highly correlated (but not perfectly correlated) with annoyance complaints. Complaints are more likely when turbines are visible or when shadow flicker occurs. Most available evidence suggests that reported health effects are related to audible low frequency noise. Complaints appear to rise with increasing outside noise levels above 35 dBA. It has been hypothesized that direct activation of the vestibular and autonomic nervous system may be responsible for less common complaints, but evidence is scant."
>
> The Massachusetts Department of Health and Department of Environmental Protection issued a report in early 2012 from an independent expert panel review of wind turbines and health. The report concludes that there is limited evidence from epidemiologic studies suggesting an association between noise from wind turbines and sleep disruption. The report further states that, while not based on

> evidence of wind turbines, there is evidence that sleep disruption can adversely affect mood, cognitive functioning, and overall sense of health and well-being. Furthermore, there is insufficient evidence that the noise from wind turbines is directly (*i.e.*, independent from an effect on annoyance or sleep) causing health problems or disease.
>
> The Massachusetts report also addressed the theory advanced by Dr. Nina Pierpont, stating that her claims regarding infrasound from wind turbines directly impacting the vestibular system have not been demonstrated scientifically. In addition, it concludes that there is no evidence to support characterizing the set of health effects identified by Dr. Pierpont as constituting a "Wind Turbine Syndrome."
>
> (Ex.-PSC-Jaeger-1 at 20-1.)

The expert witnesses providing testimony regarding health effects for Highland and the town of Forest concurred that wind turbine noise can result in annoyance and sleep disturbance for some individuals, which is consistent with the overall findings of the Minnesota and Massachusetts reviews. The expert witnesses did differ, however, on whether wind turbine noise can lead to health effects other than annoyance and sleep disruption. The position of Highland witness Dr. Mark Roberts is generally consistent with the conclusions noted above from the Minnesota and Massachusetts reviews. (Rebuttal-HWF-Roberts-12 and 21-3.) Town of Forest witnesses contend adequate information exists to conclude that direct health effects beyond annoyance result from exposure to wind turbine noise. (Surrebuttal-Forest-Punch-2, Surrebuttal-Forest-Schomer-5, Surrebuttal-Forest-Phillips-3-4 and 11-2.)

In addition to noise, Commission staff witness Michael John Jaeger and the Commission staff EA noted that shadows from moving turbine blades can cause pulsing light effects inside a home, creating an annoyance for residents. Individual reactions to shadow flicker varies greatly; some individuals may be extremely annoyed while others experience little distraction. (Direct-PSC-Jaeger-5-7; Ex.-PSC-Jaeger-1 at 27-30.)

Many individuals in the project area testified to their concerns about potential health effects. Some described existing medical conditions, including autism, which they felt might be exacerbated by living near wind turbines. The Commission staff EA briefly discussed wind turbines and individuals unusually sensitive to sensory stimuli:

> A wide body of scientific literature exists about sensory sensitivity in people with autism spectrum disorders (ASD). The National Autistic Society reports that many people with ASD "have difficulty processing everyday sensory information such as sounds, sights and smells," and the Center for Disease Control and Prevention reports that "[p]eople with an ASD might have unusual responses to touch, smell, sounds, sights, and taste." In some cases, one or more senses in individuals with ASD can be over-reactive to stimuli.
>
> For wind turbine farms, issues with sensory sensitivity in people with ASD are primarily related to visual and auditory stimuli. Noise produced by wind turbines could be unusually noticeable or distressing to individuals with increased sensitivity to auditory stimuli. Some individuals may also react to the visual stimuli of rotating blades on turbines and resulting shadow flicker. However, individuals with ASD vary widely in their responses to stimuli, and reactions to wind turbines would be difficult to predict.
>
> (Ex.-PSC-Jaeger-1 at 30.)

Many individuals residing in the Highland project area provided comments regarding their existing health conditions or those of other family members. Based on these comments, there are six residences that appear to house individuals with potentially elevated sensitivity to sensory stimuli. (Buhr, Tr. at 921-6; Cress, Tr. at 952-7; Keller, Tr. at 898-901; Miller, Tr. at 931-9; Schmidt, Tr. at 844-50; Voeltz, Direct-Forest Voice-Voeltz-1-3, Tr. at 858-60.) These individuals identified existing health conditions that included autism, balance problems, motion sickness, and elevated sensitivity to sound. Based on the current state of knowledge regarding potential health effects, however, it is not possible to determine whether the project would have resulted in noticeable effects for those individuals if built as originally proposed.

Highland witness Mr. Mundinger provided revised turbine layouts which attempt to reduce the exposures of those six residences. The alternate designs eliminate certain preferred turbine locations near the six residences and relocate those turbines to alternate turbine sites that were included as part of the project application. (Supplemental Direct-HWF-Mundinger-1-2; Ex.-HWF-Mundinger-9; Ex.-HWF-Mundinger-10.) A summary of these turbine location changes is included in Table 4.

Table 4

Wind Turbine Site	Original Layout	Revised N100 Turbine Layout	Revised N117 Turbine Layout	Revised SWT2.3 Turbine Layout	Notes
1	•	•	•	•	
2	•	•	•	•	
3	•				Removed to reduce exposure to nearby residence
4	•	•	•	•	
5	•	•	•	•	
6					
7	•	•	•	•	
8	•				Removed to reduce exposure to nearby residence; close to possible bald eagle nest
9	•	•	•	•	
10		•	•	•	Added to replace turbine removed from another location
11	•	•	•	•	
12	•	•	•	•	
13	•				Not used in redesigns to address eagle nest concerns.
15	•	•	•	•	
16	•	•	•	•	Moved on same property to reduce exposure to nearby residence
17	•	•	•	•	
18	•	•	•	•	
19	•	•	•	•	
20					
22	•	•	•	•	
23	•	•	•	•	
24	•	•	•	•	
25	•	•	•	•	
26	•	•	•	•	
27	•	•	•	•	

Wind Turbine Site	Original Layout	Revised N100 Turbine Layout	Revised N117 Turbine Layout	Revised SWT2.3 Turbine Layout	Notes
28	•	•	•	•	
29	•	•	•	•	
31	•	•	•	•	
32	•	•	•	•	
33	•	•	•	•	
34	•				Removed to reduce exposure to nearby residence
35	•	•	•	•	
36	•	•	•	•	
37	•	•	•	•	
38	•	•	•	•	
39	•	•	•	•	Moved on same property to reduce exposure to nearby residence
41	•	•	•	•	
42	•	•	•	•	
43	•	•	•	•	
44	•	•	•	•	
45	•	•	•	•	
46		•	•	•	Added to replace turbine removed from another location
48			•	•	Added to replace turbine removed from another location
49	•	•	•	•	
50				•	Added to replace turbine removed from another location
52	•	•	•	•	
53		•	•	•	Added to replace turbine removed from another location
54	•	•	•	•	
55				•	Added to replace turbine removed from another location
56					
57		•	•	•	Added to replace turbine removed from another location
61					

(Ex.-HWF-Mundinger-9.)

Mr. Mundinger's testimony also includes an evaluation of noise and shadow flicker exposures for the six residences from the revised project layouts compared to the original project layout. The revised project layouts would reduce sound and shadow flicker exposures to most of

the six residences. (Supplemental Direct-HWF-Mundinger-1-2; Ex.-HWF-Mundinger-9; Ex.-HWF-Mundinger-10.) Town of Forest witness Slaymaker also provided a table summarizing the changes in exposures to several residences in the project area, including the six residences. (Ex.-Forest-Slaymaker-5.)

The town of Forest provided information regarding a residence that might also house additional individuals with heightened sensitivity to sensory stimuli which was not considered in the revised project configurations. (Ex.-Forest-Junker-25; Ex.-Forest-Junker-26.) No individual residing in this household submitted comments or testified during the hearing.

Extensive additional testimony regarding potential health effects from wind turbines on nearby residents was provided by expert witnesses. (Direct-HWF-Roberts-D3-12, Rebuttal-HWF-Roberts-4-24, Surrebuttal-HWF-Roberts-1-6, Sur-Surrebuttal-Roberts-1-12, Tr. at 386-451; Surrebuttal-Forest-Phillips-1-13, Tr. at 657-64; Direct-Forest-Punch-4-14, Surrebuttal-Forest-Punch-1-21, Tr. 584-613; Surrebuttal-Forest-Schomer-1-17.) In addition, the testimony of Commission staff witness Mr. Jaeger and the EA also broadly summarized the issue. (Direct-PSC-Jaeger at 3-7, Ex.-PSC-Jaeger-1 at 18-23 and 27-30.) A number of individuals living near wind turbines at other existing wind developments described health problems they attribute to wind turbine noise. (Direct-Forest Voice-D. Ashley-1-3, Tr. at 239-44; Direct-Forest Voice-Bump-1-8, Tr.253-62; Direct-Forest Voice-Cappelle-1-3, Tr. 229-34; Direct-Forest Voice-Enz-1-4, Tr. 234-9; Direct-Forest Voice-Meyer-1-5, Tr. 244-53; Ex.-PSC-Lepinski-3 at 2, Mr. Jaime Fletcher; at 130, Mr. Barry Funfar; *et. al*.)

The Commission could modify the proposed turbine arrangement as appropriate to reduce noise and shadow flicker exposure to certain residences with individuals who may have

heightened sensitivity to sensory stimuli. Alternatively, the Commission could determine that modifying the proposed turbine arrangement is not necessary.

Alternative One: Modify the original turbine arrangement as proposed by Highland to reduce noise and shadow flicker exposure to six identified residences with individuals who may have heightened sensitivity to sensory stimuli.

Alternative Two: Do not require any modification of the proposed turbine locations based on any noise or shadow flicker considerations.

11. Should Highland be given the minor siting flexibility and the flexibility to use alternative turbine sites instead of preferred sites?

Any energy facility construction project may encounter an unforeseeable condition that requires some siting flexibility. Such flexibility may be needed in order to resolve unforeseen problems that could arise during the construction process, such as:

- Address unanticipated sub-surface conditions.
- Accommodate governmental requests.
- Address concerns that a landowner may have during the course of construction.
- Mitigate environmental impacts.
- Take advantage of opportunities to minimize construction costs or improve the levels of electric generation.

In other dockets, the Commission has granted CPCN project developers the ability to propose a minor siting modification, subject to review and approval by Commission staff.[3]

The Commission could consider an order condition that would allow Highland to make "minor siting modifications." These minor siting modifications would be limited to changes to proposed turbine sites only if the changes affect resources or cause impacts the Commission has

[3] *See*, for example, the Commission's "Final Decision" in *Application of Wisconsin Electric Power Company for a Certificate of Public Convenience and Necessity to Construct a Wind Electric Generation Facility and Associated Electric Facilities, to be Located in the Towns of Randolph and Scott, Columbia County, Wisconsin*, docket 6630-CE-302 at 38-40, and *Application of Wisconsin Electric Power Company for a Certificate of Public Convenience and Necessity to Construct a Wind Electric Generation Facility and Associated Electric Facilities, to be Located in Fond du Lac County*, docket 6630-CE-294, at 26-28.

already evaluated, make no significant changes in impacts to non-host landowners, meet Highland's own siting criteria, and otherwise comply with the requirements of the Final Decision. These minor siting modifications would only require notification of Commission staff. The Commission could also consider an order condition that would allow more extensive siting modifications, after review and approval of the modifications by Commission staff. Finally, the Commission could direct Commission staff to draft such provisions for any Final Decision issued in this docket consistent with previous Commission orders and the Commission's decision in this docket.

Alternative One: Yes, minor siting flexibility is appropriate.

Alternative Two: No, minor siting flexibility is not appropriate.

12. What other conditions concerning possible wildlife impacts should be attached to construction of this project to meet the requirements for Commission approval?

12a. Bird and Bat Mortality Studies

DNR witness Shari Koslowsky recommended that a post-construction bird and bat mortality study be conducted, and that the study duration be at least one year. She also recommended that bat activity monitoring occur during the same period. Ms. Koslowsky further recommended that both DNR and Commission staff review and approve the scope and methodology to be used in the study. (Direct-DNR-Koslowsky-7). Highland stated in its initial brief that it is not opposed to one year of post-construction bird and bat monitoring. (Highland Init. Br. at 14-15)

Ms. Koslowsky also recommended that, at the end of the one-year period, that "PSC and the DNR reconvene with the Applicant to determine if the study methods, scope and results allow us to make reasonable conclusions regarding the nature and extent of bat fatalities at the project site, and whether measures are needed to address those impacts. If the results are

inconclusive in these respects, then the option should remain to consider whether an additional year of study will improve the conclusions." (Direct-DNR-Koslowsky-7)

The Commission could require, as a condition of any approval of the proposed project, that Highland conduct an additional year of bat mortality study if Commission and DNR staff determine that it would substantially improve the estimate of bat fatalities and the measures to reduce bat fatalities.

12b. Bald eagles

Two active bald eagle nests have been located in the project area. A third likely nest site was also identified. Bald eagles are federally protected under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act. Highland is working with the U.S. Fish and Wildlife Service (USFWS) to evaluate the potential impact of the proposed project on bald eagles. USFWS evaluation is still ongoing. Highland has indicated that it may request a voluntary permit from USFWS to allow a certain amount of take of eagles as determined by USFWS in the course of conducting lawful operation of the proposed project. It is possible that some project changes, such as moving or eliminating certain turbine locations, may result from USFWS recommendations to minimize potential bald eagle impacts. (Direct-HWF-Drake-11-12; Ex.-HWF-Drake 2 at 7-8 and 13-14; Direct-DNR-Koslowsky-5-6; Rebuttal-Forest-Salseg-2)

The Commission could require, as a condition of any approval of the proposed project, that Highland report to the Commission any project modifications implemented to reduce potential bald eagle impacts.

Alternative One: No general conditions should be attached to construction of the proposed project, other than those previously identified and those usually included in a wind energy generating facility Final Decision.

Alternative Two: Any or all of the following conditions are appropriate:

12a. Require that Highland conduct an additional year of bat fatality study if the Commission and DNR staff determine that it would substantially improve the estimate of bat fatalities and the measures to reduce bat fatalities.

12b. Require that Highland report to the Commission any project modifications implemented to reduce potential bald eagle impacts.

13. Has the Commission's review of the project complied with the Wisconsin Environmental Policy Act (WEPA)?

The proposed action is a Type 2 action under Wis. Admin. Code PSC § 4.10(2). An EA was prepared to determine whether an EIS was necessary under Wis. Stat. § 1.11. The EA concluded that an EIS was not necessary. The public had opportunity to comment on potential environmental concerns that should be included in the EA and on the EA Preliminary Determination. The EA was included in the record as Ex.-PSC-Jaeger-1 and was referred to in Commission staff testimony. (Direct-PSC-Jaeger-1-16.)

Alternative One: Yes, the Commission's analysis and review of the proposed project meets the requirements of Wis. Stat. § 1.11 and Wis. Admin. Code ch. PSC 4.

Alternative Two: No, the Commission's analysis and review of the proposed project does not meet the requirements of Wis. Stat. § 1.11 and Wis. Admin. Code ch. PSC 4.

14. Will the project have no material adverse impact on competition in the relevant wholesale electric service market?

Uncontested Alternative: The addition of a 100 MW wind energy generation facility by Highland will not have a material adverse impact on competition in the relevant wholesale electric service market.

15. Should the Commission grant a CPCN for the project?

Highland states that the proposed project meets the requirements for issuance of a CPCN. (Ex.-HWF-Mundinger-1, Init. Br. at 29.) Clean WI supports the proposed project, and requests that the Commission issue a CPCN. (Clean WI Init. Br. at 1-2, 12-3.) Many members of the public stated that the Commission should approve the proposed project. (Goodrich, Tr. at 882-5; Lienau, Tr. at 834-8; Ulrich, Ex.-PSC-Lepinski-3 at 434-5.)

Forest Voice and the town of Forest conclude that the Commission should deny the CPCN because the proposed project, as designed, is not adequate to protect the public interest. (Forest Voice Init. Br. at 21-2, 28-9; Town of Forest Init. Br. at 28-9.) Many members of the public stated that the Commission should deny the proposed project. (Anderson, Tr. at 887-90; Lammi, Tr. at 981-96; Scepurek, Tr. at 941-8.)

Alternative One: Grant a CPCN.

Alternative Two: Grant a CPCN, with conditions.

Alternative Three: The application does not meet the requirements of Wis. Stat. § 196.491, and should be denied.

RDN:JAL:jlt:DL:00604178